

01FN046US

AMENDMENT WITH RCE

02230028aa

Amendment dated 06/09/2004

Reply to office action mailed 03/11/2004

The following is a complete listing of all claims in the application, with an indication of the status of each:

Listing of claims:

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- 1 1. (currently amended) A magneto-resistance effect element comprising:
 - 2 a lower conductive layer;
 - 3 a free layer provided on the lower conductive layer and having an
 - 4 orientation of magnetization varied by a magnetic field applied thereto, said
 - 5 free layer thereby acting as a magnetic sensing layer changing the orientation
 - 6 of magnetization in accordance with the direction and magnitude of the
 - 7 magnetic field;
 - 8 a non-magnetic layer provided on top of the free layer;
 - 9 a fixed layer provided on the non-magnetic layer and having a pinned
 - 10 orientation of magnetization;
 - 11 a vertical bias layer, provided on said lower conductive layer, for
 - 12 applying a magnetic field to said free layer, and said free layer is greater in
 - 13 length in the direction of a magnetic field applied thereto by said vertical bias
 - 14 layer than said fixed layer, and a sense current for detecting a change in
 - 15 electrical resistance of said non-magnetic layer flows substantially in
 - 16 perpendicular relation to said non-magnetic layer, and
 - 17 an underlying layer for said free layer provided under said free layer,
 - 18 and said underlying layer for said free layer being in contact with said free
 - 19 layer and said vertical bias layer, and said lower conductive layer.
- 1 2. (original) The magneto-resistance effect element according to claim 1,
- 2 wherein said lower conductive layer has a recessed portion on an upper

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3 surface thereof, and said vertical bias layer is provided so as to allow at least
4 part thereof to be buried in said recessed portion.

1 3. (original) The magneto-resistance effect element according to claim 1,
2 wherein at least part of said free layer is in direct contact with said vertical
3 bias layer.

1 4. (canceled)

1 5. (previously presented) The magneto-resistance effect element according to
2 claim 1, further comprising a vertical bias layer protective layer provided on
3 said vertical bias layer, and said vertical bias layer protective layer being in
4 contact with said vertical bias layer, and said vertical bias layer protective
5 layer being in contact with at least one of said free layer and said underlying
6 layer for said free layer.

1 6. (currently amended) A magneto-resistance effect element comprising:
2 a lower conductive layer;
3 a magnetic layer provided on the lower conductive layer;
4 a free layer provided on the magnetic layer and having an orientation
5 of magnetization varied by a magnetic field coupled magnetically to the
6 magnetic layer and applied thereto;
7 a non-magnetic layer provided on the free layer;
8 a fixed layer provided on the non-magnetic layer and having a pinned
9 orientation of magnetization; and
10 a vertical bias layer, provided on said lower conductive layer, for
11 applying a magnetic field to said free layer, and said magnetic layer is greater
12 in length in the direction of a magnetic field applied thereto by said vertical

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14 bias layer than said free layer, and a sense current for detecting a change in
15 electrical resistance of said non-magnetic layer flows substantially in
16 perpendicular relation to said non-magnetic layer, ~~and~~
17 ~~wherein an underlying said magnetic layer for said free layer provided~~
18 ~~under said free layer, and said underlying layer for said free layer being is~~ in
contact with said free layer and said vertical bias layer.

1 7. (original) The magneto-resistance effect element according to claim 6,
2 wherein said magnetic layer is magnetically coupled to said free layer by anti-
3 ferromagnetic coupling or ferromagnetic coupling.

1 8. (original) The magneto-resistance effect element according to claim 6,
2 wherein said lower conductive layer has a recessed portion on an upper
3 surface thereof, and said vertical bias layer is provided so as to allow at least
4 part thereof to be buried in said recessed portion.

1 9. (original) The magneto-resistance effect element according to claim 6,
2 wherein at least part of said free layer is in direct contact with said vertical
3 bias layer.

Claims 10-63. (canceled).
